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Name of Star.	Magnitude.	Mean R.A. 1894.			Approx. N.P.D.	
		h	m	s	°	′
11 Serpentis	6	15	27	30·27	90	50
30 Ophiuchi	6	16	55	28·17	94	4
δ Herculis	3–4	17	10	40·64	65	2
ξ Serpentis	4	17	31	30·97	105	20
ν Ophiuchi	4–3	17	53	11·40	99	46
109 Herculis	4	18	19	10·83	68	17
4 Aquilæ	5	18	39	28·91	88	3
O. A. (S.) 18841	6–5	18	49	37·84	106	30
κ Aquilæ	5–6	19	31	11·32	97	16
δ Sagittæ	4–3	19	42	39·66	71	44
23 Vulpeculæ	5–4	20	11	22·54	62	31
71 Aquilæ	4–5	20	32	51·81	91	28
ψ Capricorni	4–5	20	39	49·06	115	39
1 Pegasi	4–5	21	17	11·03	70	39
41 Capricorni	5–6	21	35	58·51	113	44
B.A.C. 7742	6	22	6	44·18	74	29
47 Aquarii	5–6	22	15	45·39	112	8
31 Pegasi	5	22	16	17·99	78	20
c^2 Aquarii	4–3	23	3	47·62	111	45
υ Pegasi	5–4	23	20	5·24	67	11
ω^1 Aquarii	5–6	23	34	17·18	104	48
20 Piscium	6–5	23	42	29·54	93	21

Radcliffe Observatory, Oxford:
1894 *June* 7.

On the R—D Discordance. By Professor H. H. Turner, M.A., B.Sc.

(*Abstract.*)

1. The following is a brief abstract of a paper by Mr. W. G. Thackeray and myself, which will shortly appear in the *Memoirs.*

2. Various researches have been undertaken by us in recent years with the view of elucidating questions connected with the R – D discordance. These have resulted in showing—

First, that the cause of the discordance can *not* be traced in one or two directions already suggested as probably the right ones.

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Secondly, that there is a direction, so far as we know not hitherto indicated, in which the cause may be sought, though we have not so far been able to complete the elucidation. This completion may very possibly involve considerable labour and demand further ingenuity; and as I have now left the Royal Observatory, it seems fitting that the results of our joint labours should be recorded without further delay.

3. In the *Memoirs* attention is first briefly called to the manner of making reflexion observations of stars. The R observation precedes the D observation, except for close circumpolar stars.

4. It is pointed out that there are limiting zenith distances, beyond which reflexion observations are untrustworthy owing to the cutting off of part of the object-glass. These are roughly Z.D. 20° to 36° until 1882, and Z.D. 22° to 65° subsequently.

5. The history of the discordance for the Greenwich transit circle is traced *de novo*: that is to say, the original observations are collected and rediscussed from 1851 to 1890. It is concluded that—

(*α*) The discordance has increased in amount during this period.

(*β*) For zenith distances 22° to 36°, which are available for all years from 1851–1890, the discordance is more nearly constant than the law sine zenith distance would allow, but is sensibly symmetrical on both sides of the zenith.

(*γ*) The period 1866–1870 is anomalous in these respects.

6. From 1882 a much larger range in zenith distance has been available for reflexion observations, and the law of increase of R—D with zenith distance can thus be examined in greater detail. The adopted formula 1″·3 sin Z.D. increases too rapidly at small and not rapidly enough at large zenith distances, the errors of formula being approximately as follows:

Z.D.	Error of Formula.	Z.D.	Error of Formula.
°	″	°	″
25	+0·06	45	+0·12
30	+0·20	50	+0·03
35	+0·28	55	−0·21
40	+0·26	60	−0·28

7. The *first* possible source of the discordance which calls for mention is ordinary flexure of the telescope as indicated by the collimators. A series of observations was made to determine this instrumental constant between March and July 1893. In all 184 determinations were made, the mean value being +0″·15. This coefficient is quite inconsistent with the explanation of an R—D discordance of 1″·3 sin Z.D. as ordinary flexure.

The results were incidentally arranged according to the external

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temperature at the time of observation as follows, suffixes indicating number of observations :

Temp.	44°	48°	52°	58°	62°	67°	75°
	″	″	″	″	″	″	″
Flexure	$-0{\cdot}02_{6}$	$+0{\cdot}09_{12}$	$+0{\cdot}04_{16}$	$+0{\cdot}14_{25}$	$+0{\cdot}19_{43}$	$+0{\cdot}20_{39}$	$+0{\cdot}35_{32}$

8. The assumption that the R—D discordance indicates a correction applicable equally but in opposite directions to R and D observations is briefly commented upon.

9. It is remarked that the R—D discordance has already been shown to have an annual variation (*M. N.* lii. 5).

10. The *second* possible source of the discordance dealt with is irregular refraction owing to heated air near the instrument. It was recently shown (*M. N.* liii. p. 424) that the excess of internal temperature is greater when the external temperature is below the average, and less when above. As an approximate numerical result it was concluded in that paper that any phenomenon depending upon the heated strata of air near the instrument *should disappear when the external temperature is* 13° *above the average, and be doubled when the external temperature is about* 13° *below the average.*

Now an analysis of the results for R—D for seven years shows that the R—D discordance is *sensibly the same for temperatures above and below the average*; and it is concluded that the chief source of the R—D discordance is *not to be sought in irregular refraction near the instrument.*

Some importance is attached to this conclusion.

11. We now come to the line of investigation which it is hoped will lead to a solution of the problem.

12. It was found that the observations of a star made in the "direct" position of the telescope, but after a reflexion observation, differed systematically from the "direct" observations made in the ordinary course. After some trouble in clearing the effects of error in adopted inclination of the horizontal wire, this systematic difference was found to be $0''{\cdot}27$, zenith distances obtained in the ordinary course being the larger.

13. The question naturally arose, "What would be the effect of reversing the usual order of operations and taking the D observation before the R observation?"

Observations of 118 stars on eleven nights have given the answer that *the* R—D *discordance is reversed in sign when the order of the* R *and* D *observations is changed*, though its new value is not quite so large as the old.

14. It would appear that this result must be not only a clue, but a key to the problem. But for some reason the key does not yet turn in the lock.

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Some Measures of Photographs of the Pleiades at the Oxford University Observatory. By Professor H. H. Turner, M.A., B.Sc.

1. The late Professor Pritchard directed his assistants to take a number of photographs of the *Pleiades* with the Astrographic Equatorial, to be accurately measured with the micrometer. His original intention was to discuss the results for relative parallax of the individual stars; while he expected at the same time to gain experience in the measurement and reduction of stellar photographs taken with this instrument, for use in discussing the plates of the Astrographic Chart. Various difficulties arose in the course of the work, which made him doubtful of being able to carry out satisfactorily his original schemes; but he expressed the hope that "at all events the attempt would issue in a catalogue of the coordinates of all the stars therein up to magnitude 12" (*Monthly Notices*, vol. liii. p. 249).

2. On being appointed to succeed Professor Pritchard, it was one of my first cares to examine the actual state of this work, the latest initiated by him. The Radcliffe Observer, who had kindly undertaken the supervision of the work of the University Observatory in the interval between the death of Professor Pritchard and the appointment of a successor, had very naturally directed that this work should be continued without change on the lines laid down by my illustrious predecessor.

3. The following is a brief statement of the position of the work as I found it at the end of 1893 December.

Seventy plates of the *Pleiades* group had been taken between 1892 August 11 and 1893 March 4.

Three plates had been completely measured in a micrometer constructed by Messrs. Troughton and Simms, furnished with a micrometer screw (in one coordinate only) reading to $0^{mm}{\cdot}01$ ($0^{mm}{\cdot}001$ by estimation): all stars visible within a radius of 40′ from *Alcyone* having been measured by reference to the *réseau* lines: viz.—

Plate 252, exposed for 6^m on 1892 December 12;
" 259, " 7^m " " " 13;
" 294, " 2^m " 1893 February 10;

also a few of the brightest stars on plates 120, 121, 128, 129, 151, 152, 153, and 258, but the measures of these eight plates were made with a different micrometer furnished with ten wires.

Reductions.—The focal length of the telescope (or scale in arc of the photograph) had been discussed for eight plates; the orientation for nine plates; and the rectilinear measures of a few stars had been corrected for refraction, precession, aberration and